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TITLE: TEPHRA LINKS FOR THE NW PACIFIC, ASIAN MAINLAND AND KAMCHATKA REGIONS

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ABSTRACT BODY: Numerous tephra layers derived from the highly explosive Kamchatka volcanic arc (NW Pacific) are buried in various deposits on the Kamchatka Peninsula as well as in the adjacent seas and on Asian mainland. EMPA and LA-ICP-MS study of individual glass shards has allowed us to geochemically characterize several large proximal tephra and correlate them over distances of 600-1700 km to the Pacific and Bering Sea cores and sites at Chukotka and Arctic coast directly linking distal paleoenvironmental records. Compositional variability of proximal glasses reveals certain spatial patterns that ensures identification of the source volcanic zone for distal tephra. Early Holocene tephra from Plosky volcano in the Central Kamchatka Depression was found in Bering Sea cores at a distance of >600 km. The tephra has high-K trachyandesitic glass; typical subduction-related pattern of incompatible elements, high concentrations of all REE (>10x primitive mantle), moderately elevated LREE/MREE (LaN/SmN~1.6), non-fractionated mantle-like ratios of LILE (K, Ba, Rb). New high-precision ¹⁴C date suggests that Plosky tephra was deposited ~10,200 cal BP that makes it a valuable marker for the early Holocene climate fluctuations.

Tephra from Gorely volcano (~40 ka BP), located behind the volcanic front in Southern Kamchatka, was found to the east (Pacific cores) and to the NNE (Chukotka) from the source at distances of 700 and 1600 km. Absence of this tephra in the Bering Sea cores northeast of Gorely suggests two separate tephra lobes that is consistent with the proximal stratigraphy. Glass from Gorely tephra is high-K rhyolite with typical subduction-related pattern of incompatible elements, high concentrations of all REE (>10x primitive mantle), and slightly spoon-shaped REE pattern (LaN/SmN ~2.3, low DyN/YbN ~0.9). Gorely tephra likely marks a glacial advance accompanied by production of icebergs (Bigg et al., 2008). Significantly older tephra compositionally identical to Gorely was found in the Pacific cores that prompts another large eruption from this volcano. Similar glass compositions for different Gorely eruptions attest to surprising stability of some magmatic systems in the dynamic arc environment and point at a possibility of tephrochronological pitfalls.

Rauchua tephra from the Arctic coast was correlated to Bering Sea and Pacific cores. Its glass has med-K rhyolite composition with typical subduction-related pattern of incompatible elements, moderate to low concentrations and nearly flat mantle-normalized pattern of MREE and HREE (~5-6x primitive mantle), moderate enrichment in LREE (LaN/SmN~2.5), strong Li enrichment (LiN/DyN~3). Geochemical features of this tephra are consistent with its origin from the Eastern Kamchatka. This tephra covers an area of >1 M km² and may represent one of the largest Kamchatka eruptions with a bulk volume exceeding ~200 km³. The research was carried out with major funding from the KALMAR project (BMBF, Germany) and RFBR (Russia). We thank A.V.Lozhkin for the samples from Rauchua and Ledovy Bluff sites.

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Additional Details

Previously Presented Material: 20% of the data have been presented at the KALMAR project workshop in 2011 in Trier, Germany

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